

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

- 1 1. (Currently Amended) A refrigeration system for providing cooling to a
2 refrigeration device, comprising:
3 a first cooling system having a refrigerant configured to communicate
4 with a heat exchanger to provide a primary cooling source;
5 a second cooling system having a coolant configured to be cooled by
6 the primary cooling source and circulated to the refrigeration device;
7 a separator device configured to receive the coolant from the
8 refrigeration device and direct coolant in a vapor state to the heat exchanger and direct
9 coolant in a liquid state to the refrigeration device
10 ~~a third cooling system configured to provide an auxiliary cooling~~
11 ~~source to the coolant;~~
12 ~~so that a pressure of the coolant does not exceed a predetermined~~
13 ~~pressure when the primary cooling source is unavailable.~~
- 1 2. (Original) The refrigeration system of Claim 1 wherein the heat
2 exchanger device is configured to at least partially condense the coolant.
- 1 3. (Currently Amended) The refrigeration system of ~~Claim 1~~ Claim 5
2 wherein the third cooling system is a standby cooling system having a standby heat
3 exchanger configured to condense at least a portion of the coolant.
- 1 4. (Original) The refrigeration system of Claim 3 wherein the standby
2 cooling system further comprises a backup power supply.

1 5. (Currently Amended) The refrigeration system of ~~Claim 3~~ Claim 1
2 further comprising a third cooling system configured to provide an auxiliary cooling
3 source to the coolant separator device configured to receive the coolant from the
4 ~~refrigeration device and direct the coolant in a vapor state to the heat exchange device~~
5 ~~and direct the coolant in a liquid state to the refrigeration device.~~

1 6. (Withdrawn) The refrigeration system of Claim 5 wherein the standby
2 heat exchanger and the separator are integrated as an assembly.

1 7. (Withdrawn) The refrigeration system of Claim 5 wherein the standby
2 heat exchanger and the separator and the heat exchanger device are integrated as an
3 assembly.

1 8. (Original) The refrigeration system of Claim 1 wherein the first
2 cooling system is a direct expansion primary refrigeration system.

1 9. (Original) The refrigeration system of Claim 1 wherein the coolant is
2 carbon dioxide.

1 10. (Original) The refrigeration system of Claim 1 wherein the coolant is
2 circulated to the refrigeration device by a pump.

1 11. (Original) The refrigeration system of Claim 10 wherein the pump is a
2 variable speed pump controlled by a superheat condition of the coolant returning from
3 the refrigeration device.

1 12. (Original) The refrigeration system of Claim 1 wherein the coolant is
2 circulated to the refrigeration device by natural circulation.

1 13. (Original) The refrigeration system of Claim 1 further comprising a
2 subcooler device communicating with the first cooling system and configured to
3 condense at least a portion of the coolant circulated to the refrigeration device.

1 14. (Original) The refrigeration system of Claim 1 wherein the second
2 cooling system further comprises a charging system.

1 15. (Original) The refrigeration system of Claim 1 wherein the heat
2 exchanger device is located at an elevated position.

1 16. (Original) The refrigeration system of Claim 1 wherein the auxiliary
2 cooling source has a heat removal capability that is less than a heat removal capability
3 of the primary cooling source.

1 17. (Original) The refrigeration system of Claim 10 wherein the operation
2 of the pump is stopped when operation of the third cooling system is initiated.

1 18. (Original) A refrigeration system, comprising:
2 a primary cooling system configured to circulate a refrigerant to a heat
3 exchanger;
4 a secondary cooling system configured to circulate a coolant to the heat
5 exchanger and at least one refrigeration device;
6 a separator configured to direct a vapor portion of the coolant to the
7 heat exchanger and a liquid portion of the coolant to the refrigeration device;
8 a third cooling system configured to cool a vapor portion of the coolant
9 from the secondary cooling system.

1 19. (Original) The refrigeration system of Claim 18 wherein the coolant
2 comprises a compound that is found in the atmosphere.

1 20. (Original) The refrigeration system of Claim 18 wherein the coolant
2 comprises carbon dioxide.

1 21. (Original) The refrigeration system of Claim 18 wherein the coolant
2 comprises a carbon dioxide blend.

1 22. (Original) The refrigeration system of Claim 18 wherein the third
2 cooling system is configured to cool at least a portion of the coolant when the primary
3 cooling system is incapable of maintaining a temperature of the coolant below a
4 predetermined temperature.

1 23. (Original) The refrigeration system of Claim 18 wherein the
2 refrigerant comprises a direct expansion refrigerant.

1 24. (Original) The refrigeration system of Claim 18 wherein the
2 refrigeration device is a low temperature device.

1 25. (Original) The refrigeration system of Claim 18 wherein the
2 refrigeration device is a medium temperature device.

1 26. (Original) The refrigeration system of Claim 18 wherein the
2 refrigeration device is a plurality of refrigeration devices and further comprising at
3 least one flow control device configured to regulate a flow of the coolant to the one or
4 more of the plurality of refrigeration devices.

1 27. (Original) The refrigeration system of Claim 18 wherein the
2 refrigeration device comprises a cooling interface configured to receive the coolant to
3 provide cooling to a space within the refrigeration device.

1 28. (Original) The refrigeration system of Claim 27 wherein the cooling
2 interface comprises a valve on an outlet of the cooling interface configured to permit
3 the coolant to expand toward an inlet of the cooling interface when the valve is closed
4 so that a liquid portion of the coolant is removed from the cooling interface prior to a
5 defrost operation.

1 29. (Original) The refrigeration system of Claim 18 wherein the secondary
2 cooling system comprises at least one pressure relief device.

1 30. (Original) The refrigeration system of Claim 29 wherein the pressure
2 relief device comprises a relief valve.

1 31. (Original) The refrigeration system of Claim 30 wherein a discharge of
2 the coolant from the relief valve is configured to be returned to the secondary cooling
3 system.

1 32. (Original) The refrigeration system of Claim 31 wherein the relief
2 valve is located proximate an outlet of the refrigeration device and the discharge of
3 the coolant is directed to a coolant return line from the refrigeration device.

1 33. (Original) The refrigeration system of Claim 18 wherein the separator
2 is oriented in a substantially horizontal configuration.

1 34. (Original) The refrigeration system of Claim 18 wherein the third
2 cooling system comprises one or more components of the primary cooling system.

1 35. (Original) The refrigeration system of Claim 18 wherein the third
2 cooling system comprises at least a portion of the primary cooling system and a
3 generator.

1 36. (Currently Amended) A refrigeration system, comprising:
2 a primary cooling system configured to provide a first source of
3 cooling to a coolant;
4 ~~a standby cooling system configured to provide a second source of~~
5 ~~cooling to the coolant;~~
6 a secondary cooling system configured to circulate the coolant to at
7 least one refrigeration device and to be cooled by the first source of cooling when the
8 ~~first source of primary cooling system is operational and to be cooled by the second~~
9 ~~source of cooling when the first source of cooling is not operational; and~~
10 at least one over-pressure protection device configured to maintain a
11 pressure of the coolant below a predetermined pressure when the primary cooling
12 system is not operational;
13 so that the ~~temperature~~ pressure of the coolant does not exceed a
14 predetermined pressure ~~temperature~~.

1 37. (Original) The refrigeration system of Claim 36 wherein the coolant
2 comprises carbon dioxide.

1 38. (Original) The refrigeration system of Claim 36 wherein the primary
2 cooling system comprises a first heat exchanger device configured to condense at least
3 a portion of the coolant.

1 39. (Original) The refrigeration system of Claim 38 wherein the secondary
2 cooling system comprises a separator device configured to receive the coolant from
3 the refrigeration device and direct a vapor portion of the coolant to the first heat
4 exchanger and direct a liquid portion of the coolant to the refrigeration device.

1 40. (Original) The refrigeration system of Claim 39 wherein the separator
2 device is configured in a substantially horizontal orientation to increase a pressure of
3 the coolant at the refrigeration device.

1 41. (Withdrawn) The refrigeration system of Claim 39 wherein the
2 separator device and the first heat exchanger are integrated as a unit.

1 42. (Withdrawn) The refrigeration system of Claim 41 wherein the first
2 heat exchanger is at least one tube-coil disposed within the separator.

1 43. (Withdrawn) The refrigeration system of Claim 41 wherein the first
2 heat exchanger is at least one plate type heat exchanger.

1 44. (Withdrawn) The refrigeration system of Claim 41 wherein the first
2 heat exchanger is a plurality of tube-coils and comprises a distributor configured to
3 interface between a coolant supply line and the plurality of tube-coils.

1 45. (Currently Amended) The refrigeration system of ~~Claim 36~~ Claim 55
2 wherein the standby cooling system comprises a power source configured to operate
3 the standby cooling system independent of the primary cooling system.

1 46. (Currently Amended) The refrigeration system of ~~Claim 39~~ Claim 55
2 wherein the standby cooling system comprises a second heat exchanger.

1 47. (Withdrawn) The refrigeration system of Claim 46 wherein the
2 separator device and the second heat exchanger are combined as an assembled unit.

1 48. (Withdrawn) The refrigeration system of Claim 47 wherein the second
2 heat exchanger is disposed within an upper portion of the separator device.

1 49. (Withdrawn) The refrigeration system of Claim 39 wherein the
2 separator device and the first heat exchanger and the second heat exchanger are
3 configured as an assembly.

1 50. (Withdrawn) The refrigeration system of Claim 36 wherein the
2 standby cooling system comprises at least one component of the primary cooling
3 system.

1 51. (Withdrawn) The refrigeration system of Claim 50 wherein the
2 standby cooling system and the primary cooling system are configured to interface
3 with a common heat exchanger.

1 52. (Original) The refrigeration system of Claim 36 wherein the secondary
2 cooling system comprises a coolant flow device configured for variable speed
3 operation.

1 53. (Original) The refrigeration system of Claim 52 wherein the coolant
2 flow device is a pump.

1 54. (Original) The refrigeration system of Claim 52 wherein the variable
2 speed operation is configured for control in response to a signal representative of a
3 temperature of the coolant.

1 55. (Currently Amended) The refrigeration system of Claim 36 further
2 comprising a standby cooling system configured to provide a second source of cooling
3 to the coolant when the primary cooling system is not operational ~~wherein the~~
4 ~~secondary cooling system includes at least one over-pressure protection device~~
5 ~~configured to maintain a pressure of the coolant below a predetermined pressure.~~

1 56. (Currently Amended) The refrigeration system of ~~Claim 55~~ Claim 36
2 wherein the over-pressure protection device is a relief valve configured to direct a
3 discharge of coolant to another location within the secondary cooling system.

1 57. (Withdrawn) The refrigeration system of Claim 36 wherein the
2 refrigeration device is at least one of a refrigerator, a freezer, a cold storage room, a
3 walk-in cooler, a reach-in cooler, an open display case, and a closed display case.

1 58. (Withdrawn) The refrigeration system of Claim 36 further comprising
2 a first coolant line configured to supply the coolant to the refrigeration device and a
3 second coolant line configured to return the coolant from the refrigeration device,
4 wherein the first coolant line is routed at least partially within the second coolant line.

1 59. (Withdrawn) A method of providing cooling to at least one cooling
2 device, comprising:

3 circulating a refrigerant to a heat exchanger;
4 circulating a coolant to the heat exchanger;
5 routing the coolant to a separator;
6 directing a vapor portion of the coolant to the heat exchanger;
7 directing a liquid portion of the coolant to the cooling device; and
8 directing the coolant from the cooling device to the separator.

1 60. (Withdrawn) The method of Claim 59 further comprising the step of
2 directing the vapor portion of the coolant to a pressure control device when a pressure
3 of the coolant exceeds a predetermined pressure.

1 61. (Withdrawn) The method of Claim 59 wherein the pressure control
2 device is a condenser device configured to provide a source of cooling from an
3 auxiliary cooling system.

1 62. (Withdrawn) The method of Claim 60 wherein the pressure control
2 device is a vessel having a volume sufficient to accommodate warming of the coolant
3 to an ambient temperature.

1 63. (Withdrawn) The method of Claim 59 wherein the coolant comprises a
2 compound found in the atmosphere.

1 64. (Withdrawn) The method of Claim 63 wherein the compound
2 comprises carbon dioxide.

1 65. (Withdrawn) The method of Claim 59 further comprising the step of
2 providing the heat exchanger and the separator as an integrated assembly.

1 66. (Withdrawn) The method of Claim 59 further comprising the step of
2 providing the heat exchanger and the separator and the condenser device as an
3 integrated assembly.

1 67. (Withdrawn) The method of Claim 59 further comprising the step of
2 providing a coolant flow device configured for variable speed control.

1 68. (Withdrawn) The method of Claim 67 further comprising the step of
2 providing a signal representative of a temperature of the coolant to regulate the
3 variable speed control and wherein the coolant flow device comprises a pump.

1 69. (Withdrawn) In a refrigeration system of a type used with a
2 refrigeration device such as a temperature controlled case used for storage and display
3 of foods for commercial sale having a primary cooling system configured to provide a
4 primary fluid as a refrigerant and a secondary cooling system coupled to the primary
5 cooling system configured to provide a secondary fluid as a coolant, the improvement
6 comprising the secondary cooling system comprising a vessel configured to provide a
7 volume to accommodate an increase in pressure of the coolant that occurs when the
8 temperature of the coolant is increased.

1 70. (Withdrawn) The refrigeration system of Claim 69 wherein the coolant
2 comprises a compound available from the atmosphere.

1 71. (Withdrawn) The refrigeration system of Claim 69 wherein the
2 compound comprises carbon dioxide.

1 72. (Withdrawn) The refrigeration system of Claim 69 wherein the
2 primary cooling system comprises a heat exchanger disposed at an elevated location.

1 73. (Withdrawn) The refrigeration system of Claim 72 wherein the coolant
2 is circulated to a cooling interface of the refrigeration device and the cooling interface
3 is disposed beneath the heat exchanger.

1 74. (Withdrawn) The refrigeration system of Claim 69 wherein the coolant
2 is circulated within the secondary cooling system by natural circulation.

1 75. (Withdrawn) The refrigeration system of Claim 69 wherein the coolant
2 is circulated within the secondary cooling system by a pump.

1 76. (Withdrawn) The refrigeration system of Claim 69 wherein the
2 secondary cooling system comprises a separator device configured to direct a vapor
3 portion of the coolant to a heat exchange device in communication with the primary
4 cooling system and to direct a liquid portion of the coolant to a refrigeration device.

1 77. (Withdrawn) The refrigeration system of Claim 76 wherein the
2 separator device is configured to maximize the height of a liquid level of coolant.

1 78. (Withdrawn) The refrigeration system of Claim 69 wherein the vessel
2 has a volume sufficient to prevent over-pressurization of the secondary cooling system
3 when the temperature of the coolant is approximately an ambient temperature.

1 79. (Withdrawn) A refrigeration system, comprising:
2 a primary cooling system configured to provide a source of cooling;
3 a secondary cooling system configured to circulate a coolant to be
4 cooled by the source of cooling, the coolant being in one of a liquid state, a vapor state
5 and a liquid-vapor state;
6 a volume inherent in the secondary cooling system and configured to
7 accommodate expansion of the coolant in the event that the source of cooling is
8 insufficient to maintain the temperature of the coolant below a predetermined
9 temperature.

1 80. (Withdrawn) The refrigeration system of Claim 79 wherein the coolant
2 comprises a naturally occurring compound.

1 81. (Withdrawn) The refrigeration system of Claim 79 wherein the
2 compound comprises carbon dioxide.

1 82. (Withdrawn) The refrigeration system of Claim 79 wherein the
2 volume inherent in the secondary system includes a vessel.

1 83. (Withdrawn) The refrigeration system of Claim 79 wherein the
2 volume inherent in the secondary system includes at least one of a piping volume, a
3 separator volume, a cooling interface volume and a heat exchanger volume.

1 84. (Withdrawn) The refrigeration system of Claim 79 wherein the
2 volume inherent in the secondary cooling system is sufficient to prevent over-
3 pressurization of the secondary cooling system when the temperature of the coolant is
4 approximately an ambient temperature.

1 85. (Withdrawn) The refrigeration system of Claim 79 wherein the
2 refrigeration device is one of a refrigerator, a freezer, a cold storage room, a walk-in
3 freezer or a reach-in cooler.